Claims

1. A dual source sputtering method for the deposition of a thin film phosphor composition onto a substrate, said method comprising the steps of:

- providing a metal as a first source
- providing a sulfur bearing compound as a second source;
- doping said first or second source with a rare earth activator; and
- applying sufficient current to the first and second sources in a sulfur containing atmosphere to effect sputtering of said first and second targets and deposition of said phosphor composition on said substrate.

2. The method of claim 1, wherein said first source is a metal of Group IIIA of the Periodic Table of Elements.

3. The method of claim 2, wherein said metal is selected from the group consisting of aluminum, gallium and indium.

4. The method of claim 3, wherein said metal is elemental aluminum.

5. The method of claim 1, wherein said sulfur bearing compound is a sulfide comprising one or more elements from group IIA and IIB of the Periodic Table of Elements.

6. The method of claim 5, wherein said sulfur bearing compound is an alkaline earth sulfide.

7. The method of claim 6, wherein said alkaline earth sulfide is barium sulfide.

8. The method of claim 6, wherein said alkaline earth sulfide is barium magnesium sulfide.

9. The method of claim 6, wherein said activator is selected from the group consisting of cerium and europium.

10. The method of claim 5, wherein said phosphor composition is an alkaline earth thioaluminate phosphor film.

11. The method of claim 10, wherein said phosphor composition is a barium thioaluminate phosphor film.

12. The method of claim 10, wherein said phosphor composition is a barium magnesium thioaluminate phosphor film.

13. The method of claim 1, wherein the sulfur containing atmosphere is selected from the group consisting of hydrogen sulfide gas and sulfur vapour.

14. The method of claim 13, wherein sputtering is conducted in a low pressure atmosphere of about 1 to 10 x 10^{-3} torr.

15. The method of claim 13, wherein sputtering is conducted in a low pressure atmosphere of about 3 to 7 x 10^{-3} torr.

16. The method of claim 15, wherein sputtering is conducted in a low pressure atmosphere of about 4 to 6 x 10^{-3} torr.

17. The method of claim 16, wherein sputtering is conducted in a low pressure atmosphere of about 5 x 10^{-3} torr.

18. The method of claim 17, wherein the sputtering rate is maximized to minimize incorporation of oxygen into said deposited phosphor composition.

19. The method of claim 18, wherein said substrate is rotated and/or oscillated to facilitate deposition of a laminated phosphor film that is alternately rich and poor in aluminum.

20. The method of claim 19, wherein the thickness of layers of the laminate are varied by altering the rotation and/or oscillation rate of the substrate.

21. The method of claim 20, wherein said method further comprises the step of homogenizing the laminated phosphor film by thermal processing.

22. The method of claim 1, wherein said deposition of said first and second targets is individually controlled by application of power in a ratio of about 1:1 to 5:1 for the first to second targets.

23. A method for depositing a film onto a substrate, said method comprising the steps of:

a) providing a substrate having a substrate surface,

b) depositing a rare earth activated alkaline earth thioaluminate phosphor composition over the substrate surface, the composition being a laminated film with a periodic composition alternatively rich and poor in aluminum.

24. A dual source sputtering method for the deposition of a thin film phosphor composition onto a substrate, said method comprising the steps of:

- placing a metal as a first source and a sulfur bearing compound as a second source within a chamber having an atmosphere of hydrogen sulfide or sulfur vapours;
- doping said first or second source with a rare earth activator; and
- applying sufficient energy to said first and second target to cause sputtering thereof and a flux of atomic species of said first and second targets onto said substrate.

25. The method of claim 24, wherein said first source is a metal of Group IIIA of the Periodic Table of Elements.

26. The method of claim 25, wherein said metal is selected from the group consisting of aluminum, gallium and indium.

27. The method of claim 24, wherein said metal is elemental aluminum.

28. The method of claim 25, wherein said sulfur bearing compound is an alkaline earth sulfide.

29. The method of claim 28, wherein said alkaline earth sulfide is barium sulfide.

30. The method of claim 28, wherein said alkaline earth sulfide is magnesium sulfide.

31. The method of claim 28, wherein said activator is selected from the group consisting of cerium and europium.

32. The method of claim 24, wherein said thin film phosphor composition is an alkaline earth thioaluminate phosphor film.

33. The method of claim 32, wherein said phosphor composition is a barium thioaluminate phosphor film.

34. The method of claim 32, wherein said phosphor composition is a barium magnesium thioaluminate phosphor film.

35. The method of claim 24, wherein sputtering is conducted in a low pressure atmosphere of about 1 to 10 x 10^{-3} torr.

36. The method of claim 35, wherein sputtering is conducted in a low pressure atmosphere of about 3 to 7 x 10^{-3} torr.

37. The method of claim 36, wherein sputtering is conducted in a low pressure atmosphere of about 4 to 6 x 10^{-3} torr.

38. The method of claim 37, wherein sputtering is conducted in a low pressure atmosphere of about 5 x 10^{-3} torr.

39. The method of claim 24, wherein the sputtering rate is maximized to minimize incorporation of oxygen into said deposited phosphor composition.

40. The method of claim 39, wherein said substrate is rotated and/or oscillated to facilitate deposition of a laminated phosphor film that is alternately rich and poor in aluminum

41. The method of claim 40, wherein the thickness of layers of the laminate are varied by altering the rotation and/or oscillation rate of the substrate.

42. The method of claim 24, wherein said method further comprises the step of homogenizing the laminated phosphor film by thermal processing.

43. The method of claim 24, wherein said deposition of said first and second targets are individually controlled by application of varying power applied to said first and second source.

44. The method of claim 43, wherein power is applied in a ratio of about 1:1 to 5:1 for the first to second targets.

45. A thin film laminated phosphor comprising;

- alternate layers of metal sulfide and rate earth doped alkaline earth sulfide.

46. A rare earth activated alkaline earth thioaluminate phosphor composition made in accordance with the method of claim 24.

47. A thick dielectric electroluminescent display comprising;

- a rigid substrate;

- a lower electrode layer directly adjacent said substrate, said lower electrode layer comprising an electrically conductive metallic film;

-a thick film dielectric layer provided on an upper surface of said electrode layer;

- a phosphor film deposited on said thick film dielectric layer, said phosphor film comprising an alkaline earth thioaluminate phosphor film: and

- an upper electrode layer comprising an optically transparent electrically conductive film.

48. The display of claim 47, wherein said phosphor film is made by the method of claim 24.

49. A method for preparing a thin film phosphor composition, said method comprising the steps of;

- placing a substrate with a reactive chamber;

- supplying a sputtering gas mixture of hydrogen sulfide at a pressure of about 5 x 10^{-3} torr to the reactive chamber;

- applying power in a ratio of about 1:1 to 5:1 to a first source of elemental aluminum and

- a second source of alkaline earth sulfide;

- said first or second source additionally comprising an activator species of selected from the group consisting of cerium and europium;

- wherein applying said power to said first and second sources causes sputtering thereof and a flux of atomic species of said first and second targets onto said substrate to form a thin film alkaline earth thioaluminate phosphor composition.

50. The method of claim 49, wherein varying levels of power are applied to said first and second sources causing differential sputtering thereof and a flux of atomic species of said first and second targets onto said substrate to form a laminated thin film alkaline earth thioaluminate phosphor composition.